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cone, the base of which is directed *forwards*, each wing of itself forms two cones, the bases of which are directed *backwards* and *outwards*, as shown at Fig. 116. In this figure the action of the wing is compared to the sculling of an oar, to which it bears considerable resemblance.¹ The one cone, viz., that with its base directed outwards, is represented at *x b d*. This cone corresponds to the area mapped out by the tip of the wing in the process of *elevating*. The second cone, viz., that with its base directed backwards, is represented at *q p n*. This cone corresponds to the area mapped out by the posterior margin of the wing in the process of *propelling*. The two cones are produced in virtue of the wing rotating on its root and along its anterior margins as it ascends and descends (Fig. 80, p. 149; Fig. 83, p. 158). The present figure (116) shows the double twisting action of the wing, the tip describing the figure of 8 indicated *a b c f g h d i j k l*; the posterior margins describing the figure of 8 indicated at *p r n*. We readily see that the cone *x b d* is formed by the downward or elevating stroke, the wing passing from *a b* to *x s* and *c d*. It is an elevating power both because of the direct lifting-power of the wing from *a b* to *x s*, and because of the action of the two wings on the wedge or cone of air formed by the line *c d* and its correspondent of the opposite side. In this case the wing is in each of its positions extended on the lines *a b*, *x s*, and *c d*. But I can't as readily explain the cone *q p n*. That this transverse section of the wing does not run parallel to the lines *o p*, *q r*, and *m n* if its edge be turned downward on the down-stroke and upward on the up-stroke, is evident. The down-stroke is the propelling one. Let us see how it produces the cone. I have added the line 1 2 to the figure to represent the position of a transverse section of the wing during its downward course. As we have been told that the primaries, secondaries, etc., roll down into this position upon the wing being extended, and as the wing is extended nearly at or upon the commencement of the down-stroke, we find that the plane of this section cuts the line *o p* at an angle of about 60°, the line *q r* at an angle of about 30°, and only becomes parallel to *m n*. Then here, as elsewhere, I have shown, we have very opposite causes producing the same effect. Now, let us see what really would be the result of this. We are told that the wing works upon compressed air, that "it produces a whirlwind of its own upon which it acts," etc. Let *q p n* represent, then, the cone of compressed air. The wing 1 2, cutting into this cone at the angle which it does, will of necessity be forced backwards towards the base *p r n*, instead of gliding along *o p*, as it would were its posterior margins elevated so that its plane lay in the direction *o p*. The same state of affairs, only reversed, would take place during the upward stroke of the wing.

In this discussion I have considered the wing as having a flat surface. That it is somewhat screw-shaped, i.e., twisted upon its axis, does not alter, so far as I can see, any of the principles here involved. It appears to me that during all of the discussion of flight Dr. Pettigrew has entirely failed to distinguish the difference between an active and a passive organ. In the inclination of the wings he has reasoned as though the air was acting on the wings instead of the opposite state of affairs, which occurs in active flight, where the wings act upon the air.

There are numerous other points in aerial, aqueous, and terrestrial locomotion where I cannot help thinking that our author has erred; but, as none of them involve such fundamental principles as have here been discussed, I will not now allude to them.

HENRY L. WARD.

Tacubaya, D. F., Mex., Dec. 30, 1890.

The American Idea of Architecture.

THE statement in a recent issue of the *Record and Guide*, that the dominant conditions of American architecture "are not those that make for the greatest beauty, or for the highest health, or for charm, but for the largest return in cash," is a most alarming indication of the estimation in which architecture is held in this country. Coming from so eminent a source, it carries additional weight, and shows very clearly that even those who by profession

¹ In sculling, strictly speaking, it is the upper surface of the oar which is most effective, whereas in flying it is the under."

are nominally responsible for all that is great or good, poor or indifferent, in the important art of architecture, have given up hope of elevating it to the broader platform which it occupied in past times; and surely, if the doctors have admitted the patient incurable, it is obviously unwise for an outsider to maintain the contrary.

This utterance of the *Record and Guide* is an admission from exalted quarters that in architecture all considerations must be sunk save those of dollars and cents. It shows, what indeed may be gathered any day in a brief walk through almost any street of our chief cities, that the idea of art quality, of utility, of the natural effects of the environment, and many similar causes whose influence is to be traced in all the good architecture of previous periods, are quite wanting in the art of the present day and generation. It is an indication of indifference to every thing but cost, of measuring art values and art qualities by the price per square inch, or, which is much the same thing, by the revenue per square foot,—most necessary to keep in mind, but altogether improper in judging of architectural merits. The point to be remembered is not the falseness of this criterion, not its absurdity, but the candid admission by an undisputed authority that it is the cardinal principle in American architecture, and that it is useless to contend against it. And, indeed, it might well be so; for if this idea has become firmly rooted in the minds of those who are concerned with architecture, who are erecting buildings as well as designing them, it is impossible to look for any better results than we have already obtained.

There is not only a popular misconception that architecture is a matter of cost, but also that it is concerned chiefly with the exteriors of buildings, and is not a science of plan, convenience, use, and similar influences. It is not the least surprising that a people who view their architecture through the medium of price should believe that the whole of it should be visible to the world at large in the exterior of their structures. That the American public is prone to judge of architecture by external æsthetic qualities is quite evident from the recent exhibition of the Architectural League in New York. This body is composed of the leading architects in the city, and its work is naturally the product of the best architectural culture in the country. Its annual exhibitions are looked upon by that section of the public interested in the serious treatment of architectural ideas as authoritative indications of whatever progress may have been made in American architecture during each year. Certainly the *personnel* of this society, and the names of those who send their work to its exhibitions, are sufficient justification for the estimation in which it is held. The exhibition that has just closed cannot be viewed as at all satisfactory to the public it was designed to instruct; and this, not because the work shown was of an inferior quality, not because it was lacking in firm, intelligent treatment, or was deficient in ideas, but because the drawings consisted solely of exteriors and picturesque effects.

It is not in the least critical of the work shown, to remark, that, in confining itself to these aspects of architecture, this important body of American architects has given its formal sanction to the idea that if a building looks well, all has been done that is needful to make it good architecture. On no other grounds does it appear possible to explain the predominance of exteriors in this collection. It is to be admitted that the artistic treatment of exteriors is one of the most important problems the architect has to deal with; but it is only one, and architecture has to do with many. It is not unreasonable to insist that it is quite as important to cover a given area well as to erect a façade that extends upwards into space for any desired distance. There is, however, a widely extended opinion that architecture is a matter of outsides, and is not at all of what is within. The outlook for American architecture is, in truth, discouraging when such a view receives the official support of an eminent body of architects.

It is not to be supposed that so advanced a journal as the *Record and Guide* should be backward in presenting the same idea. In a late issue it gave a review of the work done on the west side of New York, the seat of the most active building operations in the metropolis, in which, out of sixty-four illustrations, forty-nine were of exteriors, twelve bits of interiors, and three plans. It

would seem to be indisputable, then, that the American people are satisfied with their buildings if the outsides are good-looking. The structures illustrated in the *Record and Guide* include private residences, apartment-houses, hotels, warehouses, and churches, any one of which must have required some ingenuity in arrangement of plan, and have had some interesting constructive details, but they are carefully hidden from those who should be interested in these essential portions of architecture.

These indications of the tendency of American architecture show very clearly where the error is. The needs of the public are heeded in almost every phase of modern life and thought. The manufacturer and the shop-keeper, not less than the editor and the artist, are continually on the lookout for what the public wants, and hasten to supply them as soon as manifested. The public evidently want only exteriors in architecture. Plans, use, environment, and other matters which were once pre-eminent in the art, are now at a discount. Until the popular mind frees itself from such erroneous ideas, it will be impossible for the art to make any progress. It is well to remember that the general public which is satisfied with such things is more to blame for their continuance than the architects who prepare the designs; but it is a serious retrogression when the architects join the popular movement, and give their assent and support to it by catering to its most objectionable features.

BARR FERREE.

School of Architecture, University of Pennsylvania, Jan. 8.

Cyclones and Anticyclones.

It seems to me that the discussion in regard to the origin of cyclones and anticyclones that has been in progress in *Science* and other journals for several months past opens up a question that has so long been regarded as settled, that it seems impossible to look upon it as being in doubt. It is, in short, as to whether gravitation is the chief cause of movements of the air. Barometric observations have directed attention so forcibly to the relative weights of columns of air in storm-centres and elsewhere, that it has been assumed as a matter of course that the pressure gradients thus made manifest are the occasion of the horizontal movement apparent as wind. If this be the true explanation, in order that such horizontal movement may continue, it is necessary that there be a corresponding vertical movement, and that it be sustained by adequate renewal of the buoyancy of the air in the proper localities. This renewal of buoyancy can only be accomplished, so far as our knowledge at present extends, by heating. But now we are informed as a matter of fact that the air at anticyclonic centres descends in spite of its being warmer at an elevation, and in like manner above cyclonic centres fails to descend, although colder than at the surface of the earth. This certainly opens up the entire question as to whether there is ascensional movement at storm-centres commensurate with the extent and velocity of the winds blowing horizontally, and supposed to be due to an indraught; or, in other words, whether gravitation really plays the part that has been tacitly assigned to it, or whether it must be relegated to a subordinate position. Personally I am very glad indeed that a discussion having such bearings has come up at this particular juncture, because it has increased very decidedly my interest in following certain clues that look promising in regard to the effects of variations of the earth's magnetic condition as a whole.

M. A. VEEDER.

Lyons, N. Y., Jan. 5.

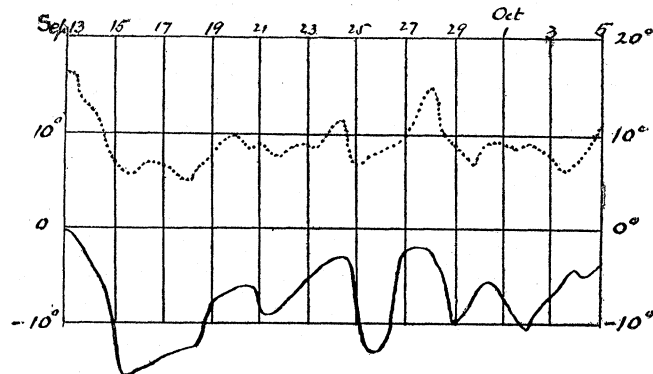
Dr. Hann and the Condensation Theory of Storms.

THE time has not yet come for a review of the various discussions upon this subject that have been published during the past four years. I doubt if there has ever been a better illustration, in the history of meteorology, of the absolute necessity there exists of appealing to observations in order to establish intricate theories, than the recent discussions on the reversal of temperature in our storms and "highs," which is but another way of putting the problem before us. In this very line Professor Davis says (*Science*, Jan. 2), "Records of temperature made on high mountain-peaks furnish the best means of testing the convectional theory of cyclones; for, even if all other tests were successfully borne, failure

under this test would be fatal to the theory." This statement of the case should be received with a little caution, however, because the presence of the mountain must be a modifying cause, and oftentimes there are cases in which some part of the storm, or high, has its action below the mountain-peaks (I have found this true especially at Pike's Peak); but the larger commotions of the atmosphere may be profitably studied at such points.

In carrying out my studies on this problem, I have invariably sought for help from the original records, which are now so abundant at Mount Washington, Pike's Peak, and at many high stations in Europe, and I have massed thousands of observations bearing on the question. The first publication of these studies was in the *American Meteorological Journal* of August, 1886, in which I showed that the temperature observations at the base and summit of Pic du Midi, in France, indicated a decided rise at both points on the approach of a storm. In October of the following year I showed by the observations at Mount Washington that in both storms and highs there was the same fluctuation at the summit as on the base, and that the mean temperature of the air-column was ten to twelve degrees higher in storms, and the same amount lower in highs, than before or after the centre had passed.

It seems to me that the crucial test in Dr. Hann's recent work, which has attracted so much attention, must be the records at the mountain stations, and I believe that this will be insisted on by Dr. Hann himself as strongly as by any one. In fact, Dr. Hann has based all his work on his interpretation of the records.



TEMPERATURE FLUCTUATIONS, 1889.

Sonnblick, full curve; Salzburg, dotted curve.

It seems to me that he has given altogether too much weight to a few isolated cases, while he has ignored hundreds of cases which disprove his propositions. I have already shown in this journal for Sept. 5, 1890, that the evidence at Sonnblick is different only in degree from that in this country, and I have there explained how the peculiar results in the remarkable high of barometer, 1889 (which, in fact, was the only one in three years exhibiting such discordances from the usual law), might be accounted for. I have now made a special study of the storm of Oct. 1, 1889, which Dr. Hann advanced as favoring his view, that the temperature in a storm falls as we rise in its centre, and at some height is lower than that of the surrounding region. The results of this investigation so remarkably corroborate my position, that I present a copy of the curves in order that others may see the exact state of the case.

These curves are constructed as follows. The lower or full curve represents the temperature observation for each day at Sonnblick, 3,095 metres (10,154 feet), at 9 P.M., at which time very nearly the mean for the twenty-four hours occurs; and the upper or dotted curve shows the temperature at precisely the same time at Salzburg, just north of Sonnblick, at a height of 437 metres (1,434 feet). I have given the curves from Sept. 13 to Oct. 5, including the storm of the 1st. It will be seen that there is a most remarkable accordance between these curves; almost every bending at the base is faithfully reproduced at the summit; and, if any thing, there is generally a greater fluctuation on the mountain than on the plain. This is not all, however. Examining the very date under discussion, Oct. 1, we find that at Sonnblick the temperature began rising on Sept. 29, and in twenty-four hours had risen